

The [ECOSPHERE research group](#) aims to study aquatic and valley ecosystems that are continuously challenged by natural and anthropogenic stressors. The research focuses on acquiring fundamental and applied knowledge at different levels of structural and functional organisation in order to underpin environmental management decisions.

MASTER THESIS SUBJECT 2023

Detecting Areas with Soil Compaction across Certain Areas in Flanders

Research group: ECOSPHERE

Hosting laboratory: CDE – building C

Promotor(s): Jan Staes (jan.staes@uantwerpen.be)

Daily supervision: Jayson Pinza (Jayson.pinza@uantwerpen.be)



Upper left: waterlogged field. Upper right: Temporary wet areas (<https://land.copernicus.eu/pan-european/high-resolution-layers/water-wetness/status-maps/water-wetness-2018>). Bottom left: Micro-scale topographical indicator. Bottom right: aerial picture with indication of waterlogging.

- This topic mostly contains ☒ literature study, ☒ lab work, ☒ field work, ☐ experimental work, ☐ GIS, ☐ numerical modelling, ☐ other:
- Possession of driver's license B is ☐ needed, ☐ recommended, ☒ not needed
- Possession of certificates needed: ☐ FELASA C, ☐ other:

Background of the Study

Soil compaction is widely considered to be an issue especially in agricultural areas worldwide in terms of agricultural productivity or even in hydrology. Soil compaction usually stunts the growth of crops by either inducing hypoxic to anoxic conditions, which are harmful for root respiration. It also serves as barrier for vertically growing roots. Furthermore, soil compaction typically inhibits groundwater recharge by acting as a barrier to percolating waters.

Thus, detecting them would be useful in these problematic areas. Visual signs of water logging can be observed after a wet period. But can we detect problematic areas using remote sensing and other geo-information such as topographic indices.

Observed inconsistencies for the Copernicus “water and wetness” layer indicate that this may be possible. First QC of the WAW initial delivery showed that the 2018 Water & Wetness (WAW) layer showed an increase in temporary wet over the mapped area compared to the 2015 product, mainly on agricultural land.

With this research, stakeholders such as farmers, the government, and non-government organizations can utilize this method to guide their preventive (e.g., planting only on areas with no compaction) or remediation measures (e.g., decompaction).

Research Question

Can soil compaction be remotely detected accurately and precisely? The imagery layer to be initially considered is Sentinel-2 color infrared layer.

Research Objectives

1. To detect occasionally waterlogged areas across Flanders (or a smaller area)
2. To validate these remotely sensed results in the field and in the laboratory

Proposed Methods

1. Remote sensing techniques
 - a. Terrascope Platform
 - b. Imagery calculations in Python or QGIS, or
 - c. Google Earth Engine
2. Validating these suspected areas in the Field and Laboratory
 - a. Field Tests
 - i. Penetrometer
 - ii. Beerkan Tests
 - iii. Soil Texture
 - b. Laboratory Measurements
 - i. Saturated Hydraulic Conductivity (Ksat)
 - ii. Bulk Density and Porosity

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